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U.S. Department of Transportation
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BOEING

Subject: Petition for Exemption from Title 14 Code of Federal Regulations section 25.809(a) at Amendment 25-116 With Respect to the Requirement that the Likely Areas of Evacuee Ground Contact Must be Viewable During "All Lighting Conditions" Prior to Opening An Emergency Exit

Model: 787

BDCO Project No.: PS06-0413

EASA Project No.: JAA/04/05/80

The Boeing Company respectfully submits this petition for exemption of the Model 787 and its minor Models from the requirements of Title 14 Code of Federal Regulations section 25.809(a) amendment 25-116 with respect to the requirement that the likely areas of evacuee ground contact must be viewable during "all lighting conditions" prior to opening an emergency exit. The enclosure to this letter provides the details of the petition in accordance with Title 14 Code of Federal Regulations section 11.81. The following summary is provided for the Federal Register in accordance with 14 CFR §11.81(f).

Summary for Federal Register
Petitioner: The Boeing Company.
Section of 14 CFR Affected: Sec. 25.809(a).
Description of Relief Sought: To allow the Boeing Model 787 relief from the requirement that the likely areas of evacuee ground contact must be viewable during "all lighting conditions" prior to opening an emergency exit.

Very truly yours,

Barry E. Nagai for.

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Enclosure: 787 Petition for Exemption from §25.809(a) Amendment 25-116

cc

Name	Letter	Enclosures	Comments
Mr. Jeff Duven	Paper	Paper	ANM-100S
Mr. Ken Schroer	Paper	Paper	ANM-100S

Petition for Exemption from 14 CFR §25.809(a) at Amendment 25-116 With Respect to the Requirement that the Likely Areas of Evacuee Ground Contact Must be Viewable During "All Lighting Conditions" Prior to Opening An Emergency Exit

Petition Overview

Under the provisions set forth in Title 14 Code of Federal Regulations (14 CFR) §11.81, The Boeing Company petitions the FAA to grant the Boeing 787 and its minor models exemption from §25.809(a) at Amendment 25-116. In accordance with §11.81(c), the extent of relief sought via this petition is limited to the part of the regulation requiring likely areas of evacuee ground contact must be viewable during "all lighting conditions" prior to opening the emergency exit. Compliance with the "all lighting conditions" requirement of the regulation would require an additional exterior emergency lighting system. The existing design 1) provides viewing of likely areas of evacuee ground contact in most lighting conditions prior to opening the emergency exit thereby allowing hazards to be identified prior to the exits being opened (note: fire, which is by far the most severe hazard, is visible in all lighting conditions) and 2) complies with all other pertinent requirements adopted in Amendment 25-116.

As required by §§11.81(d) and 11.81(e), it will be shown that granting of this petition for exemption will not adversely affect safety, and is in the "Public Interest." Per §11.81(h), Boeing requests the privileges of this exemption be extended outside the United States. This extension of privileges is necessary for operations based within foreign countries having bilateral agreements with the United States accepting FAA 14 CFR Part 25 as their airworthiness standards for transport category aircraft. The 787 is intended for the global market place with the launch customer being based in a country utilizing the United States airworthiness standards.

The FAA's stated intent for the new outside viewing requirements was not to address a known safety issue, but rather it was to bring the airworthiness standards up to date with the current state-of-the-art and existing design practice. The Model 787 has state of the art emergency exits, evacuation systems and exterior emergency lighting systems.

Petition Contents

This petition contains the following elements:

- Introduction
- Background on 14 CFR Part 25, Amendment 25-116
- Current State-of-the-Art and Existing Design Practice
- Model 787-8 Design
- Statement of no Adverse Effect on Safety
- Statement of Public Interest
- Conclusion

Introduction

With Amendment 25-116, the FAA introduced, in part, previously un-codified requirements for airframe manufacturers to provide outside viewing means at each emergency exit. While the outside viewing means provided for each emergency exit on the Model 787 are designed to meet the FAA's requirements

as they were proposed in Notice of Proposed Rule Making (NPRM) 96-9, they do not fully comply with the requirements as adopted in Amendment 25-116. Boeing is petitioning for exemption from 14 CFR 25.809(a) at Amendment 25-116 for the Model 787 and its minor models. The relief sought is limited to the part of the regulation requiring the likely area of evacuee ground contact must be viewable "*during all lighting conditions*" prior to opening the emergency exit. Like the majority of models in the jet transport fleet, the 787 exterior emergency lighting system that illuminates the likely areas of ground contact is integral to the escape slides, and thus, is not available prior to the emergency exit being opened.

The existing design of the 787 emergency exit outside viewing means provides viewing of likely areas of evacuee ground contact in most lighting conditions prior to opening the emergency exit thereby allowing hazards to be identified prior to opening the emergency exits. Fire, which is the most severe external hazard, is visible regardless of the external lighting conditions. The existing design complies with all other pertinent requirements promulgated in Amendment 25-116 including the design of the emergency lighting system integral to the escape slides which is fully compliant with the applicable sections of §25.812 "Emergency Lighting" as amended in 25-116.

Background on 14 CFR 25.809(a), Amendment 25-116

With the adoption of Amendment 25-116, the FAA amended the airworthiness standards for transport category airplanes by introducing several new cabin safety requirements. In general, the new requirements were not addressing known safety issues. The FAA's stated purpose when the new rules were proposed in NPRM 96-9 and adopted at Amendment 25-116 was to bring the airworthiness standards up to date with the current state-of-the-art and existing design practice.

NPRM 96-9 states *"...these proposals are not the result of any specific incident or recommendation, but are part of the Agency's continuing effort to upgrade the regulations to improve the overall level of safety in areas where the state-of-the-art and good design practice have indicated that such upgrades are warranted."*

The NPRM also stated that *"... this proposed rule is expected to impose minimal compliance costs on future part 25 type certificated airplanes. ...Similarly, the proposed rule would generate minimal real incremental benefits because it would codify current industry practices."*

The FAA's intention to codify the current state-of-the-art was reinforced in the preamble to Amendment 25-116 with the statement: *"These amendments are deemed necessary and appropriate by the FAA considering the current state-of-the-art and existing design practice. Although nearly all existing installations already comply, these amendments will ensure that any others comply as well."*

For reference, the text of §25.809(a) prior to Amendment 25-116, as proposed in NPRM 96-9 and as issued in Amendment 25-116 is provided below.

> §25.809(a) at amendment 25-114
> Each emergency exit, including a flight crew emergency exit, must be a movable door or hatch in the external walls of the fuselage, allowing unobstructed opening to the outside.

§25.809(a) as published in NPRM 96-9
Each emergency exit, including each flightcrew emergency exit, must be moveable door or hatch in the external walls of the fuselage, allowing unobstructed opening to the outside. In addition, each emergency exit must have means to permit viewing of the outside conditions when the exit is closed, so that likely areas of evacuee ground contact are visible. The likely areas of evacuee ground contact must be viewable with the landing gear extended as well as in all conditions of landing gear collapse. The viewing means may be on the exit, or adjacent to it provided no obstructions exist between the exit and the viewing means.

§25.809(a) at amendment 25-116
Each emergency exit, including each flightcrew emergency exit, must be a movable door or hatch in the external walls of the fuselage, allowing an unobstructed opening to the outside. In addition, each emergency exit must have means to permit viewing of the conditions outside the exit when the exit is closed. The viewing means may be on or adjacent to the exit provided no obstructions exist between the exit and the viewing means. Means must also be provided to permit viewing of the likely areas of evacuee ground contact. The likely areas of evacuee ground contact must be viewable **during all lighting conditions** with the landing gear extended as well as in all conditions of landing gear collapse.

When reviewing NPRM 96-9, Boeing fully concurred with the FAA's stated intent to codify the standard industry design practice of providing an outside viewing means on or adjacent to the emergency exits. The purpose of the outside viewing means is to enable a person to ascertain whether to open an exit, and whether it would be safe to evacuate through the exit, based on an assessment of the outside conditions. For Boeing and other airframe manufacturers, it has been a longstanding design practice to provide an outside viewing means at the emergency exits. In service, these emergency exit windows have proven to provide an effective means for assessing outside conditions. There was no indication in the NPRM that the FAA intended to change the fundamental requirements for exterior emergency lighting systems such that the industry standard use of slide integral emergency lighting systems would no longer be sufficient by and of themselves to meet the nighttime emergency evacuation lighting regulations as issued in Amendment 25-116.

As the addition of the phrase "*during all lighting conditions*" was added after the public comment period, there was no opportunity for public comment. With the addition of that phrase, the FAA effectively introduced a new requirement for exterior emergency lighting which, is not consistent with the classification in the release of Amendment 25-116 that the addition of the phrase "during all lighting conditions" is a non-substantive change. This new requirement requires an additional exterior emergency lighting system for those airplanes that use slide integral emergency lighting systems which are designed to be compliant with §25.812 (Emergency Lighting) at Amendment 25-116. The exterior emergency lighting system of the Model 787, as with most other models in-service today, is integral with the escape slides and was designed to be compliant with the requirements submitted to the public via NPRM 96-9 and is compliant with the requirements of §25.812 at Amendment 25-116.

Model 787 and Minor Model Design

The Model 787 certification basis is based upon that of the 787-8 which was initially established at Amendment 25-112. Boeing subsequently volunteered to comply with amendments through 25-116 and certain later amendments up to Amendment 25-125. However, due to Boeing's concerns with some of the new and unexpected requirements for exterior emergency lighting, an exception to Amendment 25-115 was retained for §25.809(a). As a result of moving the planned type certification date of the Model 787-8 to the first quarter of 2010, Boeing is now obligated by §21.17(d) to include these regulations at Amendment 25-116 in the certification basis of the Model 787, since the effective date of this amendment now falls beyond the 5-year type certification application window for a transport category aircraft.

With regard to the current state-of-the-art and the existing design practice of airframe manufacturers like Boeing and Airbus, the external emergency lighting systems of the jet transport fleet can be divided into two major categories; those having their external emergency lights installed in the fuselage (thereby being able to provide some level of ground illumination before the doors are opened) and those having their external emergency lights integral to the escape slides (thereby not being able to provide ground illumination until the doors are opened and the escape slides are inflated). The Model 787 fits into the latter category and it is important to note that the majority of models in the current in-service jet transport fleet also fit into this latter category. Included with the 787 are the A300, A310, A318, A319, A320, A321, A330, A340, A380, ERJ-145, ERJ-170, ERJ-190, MD-80, MD-11, 717 and 747 models. Also, as with all other models in the passenger jet transport fleet, the Model 787 does not have a dedicated exterior emergency lighting system for the flight crew overhead hatch. Therefore, if hypothetically required to do so, there are no models in the passenger jet transport fleet that could be shown compliant with the rule as adopted due to the inclusion of the phrase "*during all lighting conditions*". Boeing certainly would have contested the insertion had it been included in the NPRM. Other manufacturers likely would have as well. Thus, the FAA did not accomplish its stated intent to codify existing design practice when it issued the final rule.

The Model 787 design is complete and it includes a means at each emergency exit of viewing of the external conditions prior to the exit being opened. The emergency exit door windows meet all of the outside viewing requirements as proposed in NPRM 96-9. The windows are sized and positioned on the doors to allow for a quick assessment of external conditions. This includes on the ground in the area where evacuees would normally be expected to make contact when the airplane is positioned on all three legs of landing gear or when it is positioned at the adverse attitudes that correspond to the loss of one or more legs of landing gear. For the flight deck emergency exit, the nearby large flight deck windows provide an effective means for assessing external conditions prior to the overhead emergency exit being opened.

An inflatable escape slide/raft is installed at each emergency exit in the passenger cabin. These escape slide/rafts are sized to provide for safe evacuation of airplane occupants when the airplane is positioned normally on its landing gear and when positioned at the adverse attitudes that correspond to the loss of one or more landing gear. The escape slide/rafts are equipped with an integral emergency lighting system that illuminates the sliding lanes such that they are clearly visible in nighttime conditions to a person standing at the door and sill. In

addition, the integral slide lighting system illuminates the area on the ground where evacuees are expected to make their initial contact, thus being fully compliant with the §25.812 emergency lighting requirements. This type of exterior emergency lighting system is identical in regards to functionality as those installed on most other transport category airplane models (models listed above). It is consistent with good industry design practice and it is state-of-the-art in all regards.

Inertia reel descent devices are the evacuation assist means provided at the 787 flight deck emergency exit. These devices, which are similar to those commonly used on other models, provide for safe evacuation of the flight deck occupants when the airplane is positioned normally on its landing gear and when positioned at the adverse attitudes that correspond to the loss of one or more landing gear. Once an evacuee using an inertia reel descent device clears the fuselage, they are essentially lowered straight down in a controlled manner until they reach the ground.

With regard to the flight crew emergency exit, the FAA has acknowledged that the large flight deck windows will normally provide an adequate means for assessing outside conditions when determining whether to open the flight deck exit. In the preamble to Amendment 25-116, the FAA stated that "*In most cases, it should be possible to view the outside conditions sufficiently well from a nearby passenger or flightdeck window to ascertain whether to open an overhead exit. This is considered acceptable.*" Since the outside viewing capability provided by the 787 flight deck windows is consistent with that of nearly every other widebody model in-service today, the 787 flight crew exit is considered compliant with the intent of §25.809(a) as proposed in NPRM 96-9. However, as with all other models in the passenger jet transport fleet, the Model 787 does not have an exterior emergency lighting system at the flight crew exit.

The 787 door windows provide superior outside viewing capability. As stated in the preamble to Amendment 25-116, "*The provisions of this rule reflect current industry practices. The primary potential benefit of the final rule is that it will require these current practices to be continued in the future.*" As compared to most other models in-services today, the 787 door windows provide superior means at the emergency exits for assessing outside conditions. The 787 passenger door window size is nearly 500% larger than the vast majority of exit door windows in service today. The 787 door windows provide superior viewing capability compared to the vast majority of smaller door windows in the current jet transport fleet.

The 787 basic design was established prior to the issuance of Amendment 25-116. It wasn't until after Boeing established the basic design of the door windows and the exterior emergency lighting system that the FAA issued Amendment 25-116. After the final rule was published Boeing raised its concerns with the insertion of the phrase *"during all lighting conditions"*. However, this issue was not resolved. It wasn't until the program schedule revision in January 2009 that Boeing determined the need to move the type certification date of the Model 787-8 into early 2010, thus requiring that all of Amendment 25-116 be included in the certification basis.

Full compliance with the adopted rule will be disruptive and costly with no appreciable benefit.
In the preamble to Amendment 25-116, the FAA acknowledged the technical difficulties and resultant costs associated with modifying existing airplanes, and thus there was no requirement to retrofit in-service models. While the Model 787 has not yet entered service, airplanes have already entered final assembly and dozens will have been built before a fully compliant exterior emergency lighting system could be developed. Furthermore, since the new exterior lighting system will require penetrations in the fuselage that were not accounted for when the large mandrels that are used in the manufacturing of the monolithic composite fuselage sections were built, any new penetrations will have to be handled as post-build modifications to the fuselage sections. Therefore, the incorporation of a new exterior lighting system this late in the program would essentially be of a retrofit type, and would be very disruptive and costly with no appreciable benefit.

Statement of no Adverse Effect on Safety
Granting this petition will have no adverse effect on the level of safety. The FAA's stated intent was to upgrade the regulations to improve the overall level of safety in areas where the state-of-the-art and good design practice have indicated that such upgrades are warranted. As such, the FAA acknowledged that the new rule would generate minimal real incremental benefits because it would codify current industry practices. The outside viewing means and exterior emergency lighting system that have been developed for the 787 are consistent with good industry design practice and are state-of-the-art in all regards.

During a time-critical emergency evacuation, an external fire is the principal external hazard that can pose a more immediate threat to the occupants of the airplane if the exit is opened. An external fire is readily visible in both day and nighttime conditions and the large 787 passenger door windows and the flight deck windows provide for a wide, undistorted viewing area when assessing for fire and other possible external threats. Boeing has reviewed several airplane accident databases and found no evidence of pertinent service history that any in-service injuries or fatalities could have been prevented had those airplanes been in full compliance with the "*during all lighting conditions*" provision of §25.809(a) at Amendment 25-116. Therefore, there is no appreciable difference between the level of safety provided by the 787 door window design and that specified by the new regulation.

Statement of Public Interest
Grant of this exemption is in the public interest. There is no adverse effect on safety. The grant of exemption will allow the avoidance of the added weight, complexity, maintenance costs, and environmental impact associated with the extra lighting system. Conversely, if required to add this new system, an increase in weight and complexity to the 787 would occur, resulting in an increased burden for airline operators due to the maintenance, and spare parts provisioning that would be required, as well as an increase in both fuel burn and emissions. Preliminary estimates indicate an increase of ~ 50 pounds of airplane operational empty weight (OEW) associated with this extra lighting system. This translates into approximately 15,000 gallons of additional fuel usage per airplane over its operating life with an associated 323,000 pounds of CO_2 emissions. For a fleet of 1000 airplanes this would amount to ~15,000,000 gallons of fuel and 323,000,000 pounds of CO_2. Therefore, granting the exemption would contribute to keeping airfare costs under control thus helping our airline customers to

remain competitive while making a positive contribution to the environment. It should be emphasized that the 787 exit windows in combination with its external emergency lighting system being integral with the escape slides is state-of-the-art and provides the level of safety that the FAA intended to promulgate with the new rule.

Conclusion

All Model 787 passenger doors have windows that are sized and positioned to allow for a quick assessment of external conditions. This includes the area where the evacuees would normally be expected to make contact on the ground when the airplane is positioned at a normal attitude or at the adverse attitudes that correspond to the loss of one or more legs of landing gear. The large size of the 787 door windows, compared to the vast majority of emergency exit windows in service today, allow the ground viewing without the need for a prism or Fresnel lens, which can distort the view out the window. The 787 door windows and the flight deck windows comply fully with the intent of the new regulation as proposed in NPRM 96-9, and they provide a level of safety equivalent to the vast majority of models in the jet transport fleet, which was the FAA's stated intent when codifying the requirement for an outside viewing means at the emergency exits. Passenger and crew safety will not be degraded by grant of this exemption.